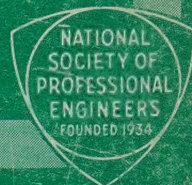




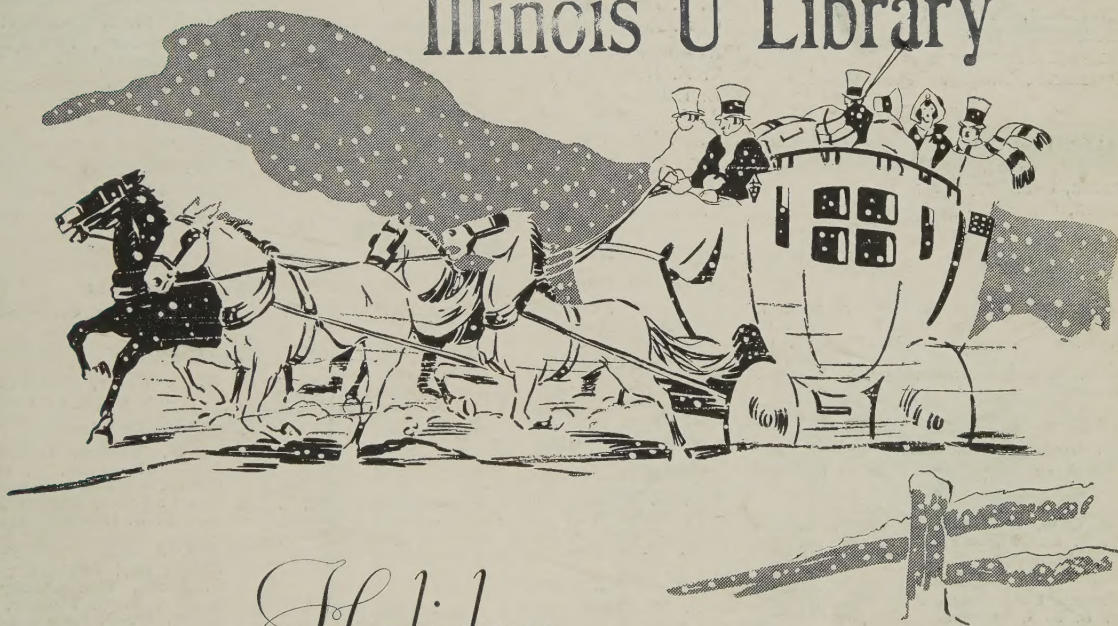
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THE ILLINOIS ENGINEER, DECEMBER, 1950—VOLUME XXVI, NO. 12

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Of Professional Interest

TENTATIVE PROGRAM FOR SIXTY-SIXTH ANNUAL MEETING

The tentative program for the 66th Annual Meeting has been arranged and is given below. All of the meetings with the exception of the Ladies' Entertainment will be held in the Illinois Union Building on the Campus of the University of Illinois. Housing arrangements have been worked out with the hotels and also with the University of Illinois Men's Residence Hall. There is no excuse for not coming to Urbana this year as the Housing Committee can take care of 250 men in the "Hall." It might be a novelty for you to spend Friday night in the Hall and compare modern college living with conditions when you were on the campus. The price is extremely reasonable. Come back to college.

The tentative program follows:

Thursday, February 1st

- 0:00 a. m. Registration opens in the Union Building
- Inspection Trip
- 10:00 a. m. Board of Direction Meeting
- 1:30 p. m. Open Board Meeting to hear discussion of committee reports
- p. m. Social Gathering and Smoker, Garden Room, Urbana Lincoln Hotel

Friday, February 2nd

- 9:00 a. m. Moving Picture
- 10:00 a. m. Inspection Trip
- 10:00 a. m. Opening of the 66th Annual Business Meeting. Talks on appropriate subjects followed by discussion
- 12:00 noon Luncheon
- 1:30 p. m. Continuation of Business Meeting
- 4:00 p. m. Inspection Trip
- 5:00 p. m. Adjournment of Business Meeting to Saturday morning
- 7:00 p. m. Annual Banquet, Ball Room, Illinois Union Building

Saturday, February 3rd

- 9:00 a. m. Moving Picture
- 9:30 a. m. Continuation Annual Business Meeting
- 12:00 noon Close 66th Annual Meeting
- 12:00 noon Luncheon and Organization of the 67th Board of Direction

NOTICE

CONFERENCE ON HIGHWAY ENGINEERING

The 37th Illinois Annual Conference on Highway Engineering is to be held in Urbana during the period February 20-22, 1951.

More details concerning the conference will be published in the January issue of this magazine.

COST OF LIVING INDEX

The correction factor to be applied to the I. S. P. E. Schedule of Minimum Fees and Salaries was 174.8 for October, 1950. The factor is based upon the U. S. Department of Labor's most recent Consumer Price Index.

PRESIDENT'S MESSAGE

At this time of the year our hearts and minds are filled with noble feelings for our fellow-men and thoughts of ways by which we may better serve.

Would that this feeling of brotherly concern which pervades all of us now to greater or lesser degree encompass especially our fellow engineers, so that as the new year begins each of us may resolve to devote a little more time, a little more attention, a little more energy—and, yes, a little more money—to our special field of effort by which we strive to improve our profession and through it the world in which we live.

To each of you I extend my heartiest wishes for a Merry Christmas and a Happy New Year—a new year fraught with significant professional advancement more marked than has been attained by our Society in any previous year.

Accordingly I hope that a large number of members of the Society are planning to attend the next annual convention. Only by attendance at and participation in this business meeting of the Society can the members properly help to determine its policies, as they should. Here's looking for several hundred of you at Urbana, February 1-3.

My grateful thanks are extended to the Illinois Valley, the Egyptian, and the Peoria Chapters for their gracious hospitality in November.

GEORGE E. EKBLAW, *President*

VOX SECRETARII

P. E. ROBERTS, *Assistant Secretary*

Membership

Interest in membership is again reviving after a long dry spell. Ten applications were received by your Secretary's Office immediately after Thanksgiving. Twelve more mail receipts of a like kind will put us over the top with a total of 2,000 members, all grades. Lake, Illinois Valley, Kewanee and Joliet Chapters accounted for the ten applications. From now on, each one counts

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SUBSCRIPTION RATES

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—GET TWO—and we will have the much needed TWO THOUSAND.

Dues Payment

1951 Dues Statements were put in the mail during the first week in December. The method of making this annual notice of dues due worked well last year so the form is familiar to all but the new members. Again we are asking that you return the statement with your check. This method has simplified the work of the office and has helped us not only to keep our mailing list up to date but also in the other detail work connected with the records. Your cooperation in sending your 1951 dues to the State office by return mail helps more than you know. Also it saves your Society money for the reason that the more dues received as a result of the mailing of the first notice, the fewer second notices to be prepared and sent out.

Ballots

In the same envelope is a ballot, a ballot envelope and for your further convenience a return envelope. Last year a record of 652 votes for the 1950 officers were received. This is approximately three-fifths of the corporate membership. Keep the habit of voting—send in a vote with your 1951 dues check. Remember, a heavy vote puts a heavy responsibility of the affairs of the Society on the officers you elect.

Miscellany

Professor and Mrs. Babbitt are headed for the West Coast and are due back in Champaign-Urbana on January 26th. . . . Anything can happen; if you do not believe it, ask Mr. Eliot and his staff of coaches. . . . Winter did not monkey around getting here this year; in fact, "the old man" was just a month early.

MEMBERS OF CIVIL ENGINEERING STAFF, UNIVERSITY OF ILLINOIS, RECEIVE AWARD

J. W. Briscoe and E. R. Bretscher, members of N. S. P. E. and on the University of Illinois Civil Engineering faculty, received an Honorable Mention Award from the James F. Lincoln Arc Welding Competition. This is an annual competition, held to encourage the development of welded design. The design of Professors Bretscher and Briscoe consisted of a tied arch with eight panels and a rise of 65 feet at the center. Each arch rib was composed of four extra strong 6-inch pipes, two vertical webs, one cover plate and one bottom perforated plate.

The Illinois Society extends congratulations.

NOMINATIONS FOR HONORARY MEMBERSHIP

Arthur Cutts Willard, President Emeritus, University of Illinois, and J. J. Woltmann, Consulting Engineer of Bloomington, Illinois, have been proposed for honorary membership in the Illinois Society of Professional Engineers.

These candidates for honorary membership were approved by the Board of Direction at its meeting of No-

vember 4, 1950, in accordance with the Society constitution. They were proposed by the Honorary Membership Committee, Duncan M. Campbell, chairman, and W. J. Putnam and C. M. Slaymaker, members.

The constitution states that "An Honorary Member shall be a person who has attained eminence in some branch of engineering or related science or who has rendered signal service to the engineering profession or to the Society," and, "Names of candidates for honorary membership may be proposed either by the Board of Direction or by written petition to the Board, signed by not less than ten corporate members. Names of candidates approved by the Board shall be submitted to the corporate membership for election by letter ballot. Favorable votes of two-thirds of the members voting, not less than fifty in number, shall be required for election."

EXCERPT FROM REPORT OF EXECUTIVE SECRETARY LEGARE

Annual Meeting N. C. S. B. E. E., October, 1950

Member Boards and Number of Registrants—The National Council of State Boards of Engineering Examiners is composed of 52 legally constituted Boards of Engineering Registration or Examiners. These Member Boards have a total of 300 official members. The Congress of the United States of America and the State Legislatures of seventy (70%) per cent of the States have legally recognized NCSBEE as a national agency by naming it, or one of its functions, National Bureau of Engineering Registration, in Legislative Acts. The number of registrants in good standing as of June 1950 as reported by the Member Boards is as follows: professional engineers 159,759; land surveyors (not engineers) 9,104; total number of registrants 168,863. The number of registered land surveyors reported here does not represent the actual number of land surveyors in the United States as some states have separate departments for land surveyors and the reports of these departments are not available at this time. The number of non-resident engineers reported is 25,626; however, many of these are duplications as some of these registrants are registered in a number of states. The number of Engineers-in-Training that have been certified to date is 18,647. The number of registered engineers shown for the State of Illinois represents the professional engineers only and in addition to these there are also a number of registered structural engineers who are not registered as professional engineers, but this number is not available. Due to the discrepancies and duplications referred to above, an accurate number of registered engineers cannot be reported; however, it is estimated that there are at least 157,000 registered professional engineers in good standing in the United States and Territories.

Reports to the National Safety Council show that in 1948, 31 per cent of drivers involved in fatal traffic accidents, or nearly one out of three, were less than 25 years of age.

Report of the National Director

N. S. P. E. Board of Direction Meeting, Little Rock, Arkansas

W. A. OLIVER

While your National Director is always impressed with the importance of N. S. P. E. business, it seemed to him that there were a greater number of important matters discussed at Little Rock than at any meeting of the National Board it has been his duty to attend. Professional unification, civil and national defense and their effect upon the young engineer, upon engineering education and upon the engineering profession generally, the 1951 national legislative program, etc., etc.—all received due consideration on November 3rd and 4th, at Little Rock.

The following report covers the high points of that meeting as observed by the writer with pertinent quotations from the committee reports under discussion.

The efforts toward the unification of the profession appealed to your National Director as one of the most important projects being carried on by the National Society at the present time. Mr. Alex Van Praag has been spearheading this effort for several years and has devoted long hours and much energy toward its accomplishment.

The matter is being considered by the so-called "Joint Committee of Sixteen," made up of representatives from sixteen engineering societies. This committee has been studying three possible plans of unification and recently a fourth has been added. The first plan proposes the expansion of Engineers Joint Council which is made up of representatives from the founder and other technical societies and depends upon the controlling body of those societies for its existence. It can take no action without the approval of the boards of the member organizations. This results in delayed action or no action at all. Furthermore, any one society is in a position to veto action for the whole group. The second plan proposes the expansion of the N. S. P. E. into an overall unifying agency, including all branches of the profession and directly controlled by the votes of the individual members. The third is a compromise plan, whereby E. J. C. and N. S. P. E. would combine their activities. And finally, the recent fourth plan as proposed by the American Society of Mechanical Engineers would have the member hold his membership in the Unified Group by virtue of his membership in his technical society. His membership in his technical society would automatically make him a member of the Unified Group and his dues to the latter group would be paid by his technical society. To some extent this has the appearance of a modified E. J. C. plan.

A consideration of the above proposals will show that the N. S. P. E. plan is the only one, based upon the true principles of democracy. It is the only one of the four plans where the "grass roots" member will by his vote be able to control directly through his elected representatives the Unified Group and its policies.

At the present moment, it would appear that the engineering profession is further than ever from the goal of unification. And while the hope of a united profession does seem to grow dimmer rather than brighter, every encouragement should be given to the N. S. P. E. and its able representative, Alex Van Praag, to continue the battle.

In his report given at Little Rock, N.S.P.E. President Stolte used a very apt phrase, *A Garrisoned Economy*, stating that the United States in all phases of its existence, including its struggle to preserve democratic civilization, will face that type of economy for many years to come. To some extent the phrase may be said to have struck the keynote of the Little Rock meeting. Certainly, the joint report of the Committee on the Young Engineer, the Committee on Education and the Committee on National Defense proposed provision for a "garrisoned economy" in its statement of policy on national defense.

As stated above, the report of this joint committee includes a statement of policy concerning national defense and the engineering profession. The N. S. P. E. Board accepted the principles set forth in this statement. This matter is so important to all engineers that the writer believes that the statement should be presented in full. Consequently, it will be found appended to the end of this report.

This statement of policy proposes the establishment of a method whereby a sufficient number of engineering and scientific students will be allowed to complete their training so that the future needs of industry as well as of the military can adequately be met. This is a matter which is already exercising the attention not only of the engineering educators who are, of course, immediately concerned with the problem but, also, of the entire industry of the nation. Young engineers are at present in scarce supply and there is evidence to support the view that the number will become less adequate to meet the demand. There are several reasons to account for this situation. A low birth rate during the depression years of the early thirties is one of the important reasons why the enrollment in engineering colleges during the present year has decreased to such an extent that it is

bound to become critical in the years ahead. Furthermore, the shortsighted policy adopted by the federal government during World War II, toward the maintenance of an adequate supply of engineering students in training to meet the future needs of the country, has resulted in a shortage of young engineers with five or six years experience, that is, of men who would have completed their training during the war years.

It is to be hoped that the present national defense authorities will recognize the seriousness of the situation and will establish a definite and adequate policy to provide for its correction.

With the national Congress in recess, the Legislative Committee of the N. S. P. E. has been in the position where it could draw a breath between bouts, to express it metaphorically. Consequently, it could review past accomplishments and look forward to new tasks to be undertaken. The report of this committee referred to the registration law which recently went into effect in Washington, D. C. Certainly, the N. S. P. E. can claim some of the credit for having had this law passed. There is now an engineering registration law in all of the States and other integrated political sub-divisions of the United States.

The final paragraph of the report of the Legislative Committee states not only the basic problem which faces that committee in the future but, also, the problem which will be of primary importance to the entire Society. The paragraph is as follows: "What our legislative interests may be in the period ahead depend to some extent on the outcome of the Congressional elections this month, and to a larger extent on the state of world affairs. While it is impossible to predict the course of events the Legislative Committee believes that our primary interest will lie in the problems brought about by mobilization, building up the armed forces, possible economic controls and other items related to our defense status. With the background of past policy statements and actions by this Board, and with the cooperation of the Executive Committee as new problems are encountered, the Legislative Committee will endeavor to meet the critical times with two objectives in mind:

1. To provide the fullest aid and support of the engineering profession to the National Defense.
2. To enhance and protect the interests of the engineering profession consistent with the first objective."

Information concerning the Public Relations Fund Campaign will be in the hands of the Society membership by the time this report is in print. It is unfortunate that this drive for contributions runs parallel to the drive for funds for a Legislative Analyst being carried on by the Illinois Society. This fact was called to the attention of the N. S. P. E. Board by your National Director at the meeting in Boston, last June.

A recent and attractive brochure has been published by the N. S. P. E. which gives an annual report of the national society activities for the administrative year

1949-1950. This report will be mailed to each member of the Society. Look for it and read it carefully. It gives in condensed form a review of recent Society accomplishments.

A report on N. S. P. E. affairs is never complete without reference to membership. The report on membership at Little Rock showed a total of 23,000 plus, an increase of approximately two thousand over what was reported a year ago at this time. There are now thirty-five affiliated state societies. The thirty-fifth member state, Delaware, was admitted to membership at Little Rock.

In the above, the writer believes that he has given a brief the most important problems which are being considered by the National Society at the present time. For further details the reader is referred to the pages of the ILLINOIS ENGINEER and the AMERICAN ENGINEER. *Be sure to read the Statement of policy concerning National Defense and the Engineering Profession which immediately follows this report.*

National Defense and the Engineering Profession A Statement of Policy

Preface

The total defense of the United States and not the best interests of any group or any individual is the basic consideration for all questions to be resolved in this policy statement of the National Society of Professional Engineers.

General Policy

The objective of the engineering profession must in time of international stress be the development of the means to provide a maximum contribution to the military strength of the nation and the maximum production to support that military strength. The two requirements are mutually dependent and require the utmost in service from professional engineers for maximum effectiveness.

In the military service it is necessary that the best talent be available to manage and direct the many engineering problems of a modern army, likewise that those charged with military engineering responsibility be professionally qualified. No nation so abundant in technical and professional talent that it can afford to waste the use of such technical skill and professional abilities in capacities below the maximum level at which such skills and talents can serve.

In the production effort which must support the military service it is necessary that the best and the most in modern weapons and material must be made available to the armed services and at the same time provide a sound base for the civilian economy. This task will require the services of professional engineers in increasing numbers. It will also require a continuous flow of engineers for training and for obtaining experience to replace the normal attrition if the depletion of technical personnel during an extended period of full or partial military mobilization is to be prevented.

These objectives must be achieved if the most is to be made of our available engineering resources. However, many complex factors enter into the detailed arrangements required to put these objectives into effective operation.

Engineers in Military Service

A large military organization is likely to waste technical abilities and professional talents. The experiences in World War II clearly demonstrated the failure to adequately use the professional talents available in the armed service because adequate preparation for such use was not made sufficiently far in advance. Many qualified professional engineers in the armed services were often assigned

(Continued on page 14)

Small Steam Prime Movers for Power Generation

J. H. POTTER

Professor of Mechanical Engineering, University of Illinois

Summary

During the winter of 1949-50 a survey was made to investigate the present status of steam engines and steam turbines used for electric power generation in ratings of 1000 kw. and less. All of the current manufacturers of such machinery were contacted. The replies to a questionnaire sent to these manufacturers reflect the technical and economic progress that has been made in the small steam prime mover field. The results are of interest generally, and may prove valuable to plant engineers and executives as well as to those responsible for the design of small power plants.

I. Introduction

In the field of large prime movers, the steam turbine largely displaced the steam engine prior to World War I. Small physical dimensions, decreased maintenance, higher temperatures and pressures at the throttle, ability to operate on the regenerative cycle, and to benefit by low back pressures—all played a part in the acceptance of the turbine. In units of smaller capacity, however, the engine continued to be a competitor long after the steam turbine was established as the large prime mover.

In order to answer the question, "What are the relative positions today of the small turbine and engine?"... a survey was undertaken during the winter of 1949-50. Certain results of this survey are embodied in this paper.

As some national political "polls" have shown, sampling methods must be carefully scrutinized if erroneous conclusions are to be avoided. It was therefore decided that a "100%" sample would be sought, and to accomplish this every American builder of turbines and engines was contacted. A carefully phrased questionnaire was sent to each manufacturer, specifically stating the nature of the information required and advising the builder as to how these data were to be used. As the small prime mover was the object of the investigation, information was requested on units rated at 1000 kw. and smaller. The name plate ratings were taken with a power factor of 0.8. Each builder was asked to report on at least three units in the capacity range indicated, giving full particulars as to dimensions, weights, speed, and steam conditions. Performance data were also requested. Information was asked for each of these capacities when designed for condensing operation, and also for atmospheric backpressure. In order to reduce to a minimum the builder's time and effort, no limits were placed on steam conditions, and he was asked to report on what approximated a standard design by his com-

pany. It was also suggested that past performances of actual machines could be drawn upon.

The builders were very cooperative, and some of them went to considerable trouble to prepare tables of information. A few sent catalogs or marked blueprints. Some of the replies of the engine builders were highly illuminating, revealing some of the specialized fields other than power generation in which engines are still required.

It is important to state that the survey was limited in scope to steam turbines and steam engines, even though the capacity range under consideration is that in which diesel-type internal combustion engines are being widely installed.

The cost data were complete prior to the start of the Korean War and, as they were collected over a period of only a few months, may be considered comparable. The fact that prices of most commodities have risen since the survey was completed may render the specific cost figures obsolete. However, the data clearly indicate comparative costs.

II. The Steam Engine

The story of the invention of the steam engine is too well known to recount here. The various improvements in the engine that were made by Watt, Corliss, Zeuner, and many others, all tended to increase its mechanical and thermal efficiencies and to improve astoundingly man's power to cope with his environment. The sociologists warn that man has never fully adjusted himself to the economic changes which followed the development of the steam engine. If lessons are to be drawn from the history of the steam engine, two at least are of prime importance: (1) the engine was invented to meet a specific economic need, and (2) the benefits of the invention spread far afield, creating or stimulating other industries.

The limitations of the engine were felt toward the end of the nineteenth century. Greater output called for larger cylinders, higher piston speeds, and improved valve gear. To fully utilize the expansive power of the steam, multiple cylinder arrangements were adopted. The compound, triple-expansion, and quadruple expansion types appeared in response to the need for higher capacity and better economy.

The uniflow engine was one of the later developments. It combined low steam rates with greater simplicity than the earlier types, giving high efficiency over a wide range of load.¹ It is interesting to note that the engine manufacturers responding to this survey build only uniflow or single-cylinder counterflow engines for the particular service conditions covered here.

III. The Steam Turbine

The advent of the steam turbine in the 1880's ushered in an era of compact, high-speed, power machinery. Turbines were able to take fuller advantage of high vacuum, and later were to profit from high steam temperatures and pressures at the throttle. Of all the immediate advantages the most important were the reductions in weight and floor space. Prout has shown this most vividly, comparing the floor areas required for a Corliss engine and a turbine of the same capacity,² and by superimposing a turbine photograph on an isometric drawing of an equivalent engine.³

Reduction gearing helped the turbine to invade the small power field, offering greater compactness and permitting higher turbine speeds. Smaller foundations and lower maintenance costs favored the turbine. The economies made possible by bleeder feed water heating further enhanced its position.

IV. Present Status

Based upon the replies to the questionnaire, the following observations may be made:

(a) *Floor Space.* Comparison data are not plentiful, but it is of some interest to contrast the 1913 values of Fernald⁴ with some approximations drawn from the present survey:*

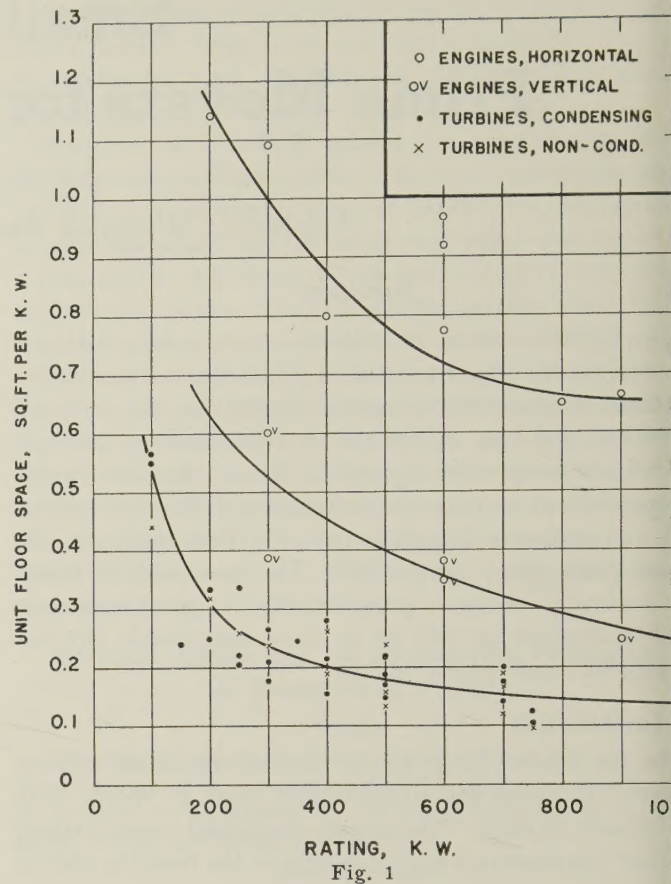
Rating, K. W.	Ratio of Engine Area to Turbine Area		
	Fernald	Present	
		Horizontal	Vertical
500	5.57	3.86	1.82
1,000	6.43	3.34	1.50

* In the table above horizontal and vertical engines are compared in space ratios to horizontal turbines; no vertical turbines are built nowadays.

Space requirements have been sharply reduced for both types of engines, the vertical machine offering greater compactness.

Unit floor space, square feet per kilo-watt, is shown plotted against rating in Fig. 1. The curves have been drawn only to indicate trends of the data on the several types of machines. The engine builders did not in general indicate any difference in required area between atmospheric and condensing machines. As a result, the engine points carry no distinguishing mark for back-pressure. The vertical machines are identified by a "V" to the right of the circle. As is shown by the solid dots and crosses, condensing operation does not necessarily affect the space requirements of the turbines. From Fig. 1 it is evident that the turbine is still to be chosen on the basis of compactness.

(b) *First Cost.* The cost data included prime movers, generators, and exciters. Non-condensing engines were generally priced as high as condensing units of the same size. In general, the cost of engine-generator sets exceeded turbo-generators by more than twenty per cent.



To a considerable extent this is due to the larger generators required for engine driven sets.

Unit cost, dollars per kilo-watt, has been plotted in Fig. 2. Here again the curves are intended to indicate a trend only. The three engine points that fall in the competitive turbine range represent a single manufacturer and are exceptions to the general average unit costs.

In some cases the turbine builders quoted several prices for the same capacity machine, depending upon the inlet steam conditions. It is appropriate for comparison purposes to select in each case the lowest unit cost for the turbine set, as these represent throttle conditions more closely approximating those of the engine.

The direct-drive machines appear in the costlier part of the turbine category, with the atmospheric set slightly less expensive than the condensing units. Of the geared turbo-generator sets the non-condensing type was markedly less expensive.

One of the prime reasons for the lower first cost of the turbine has been the widespread standardization of motors, governors, blading, casings, etc., and the application of large scale manufacturing techniques. It is interesting to note in Fig. 2 the fall of the turbine unit cost with increase in rating. Up to 400 kw. there is a steady decrease of unit cost, reflecting the range of one series of standardized components. After 500 kw. the downward trend is reestablished with another series of parts.

Some types of machines are compared on a "cost per pound" basis. In small power prime movers this factor

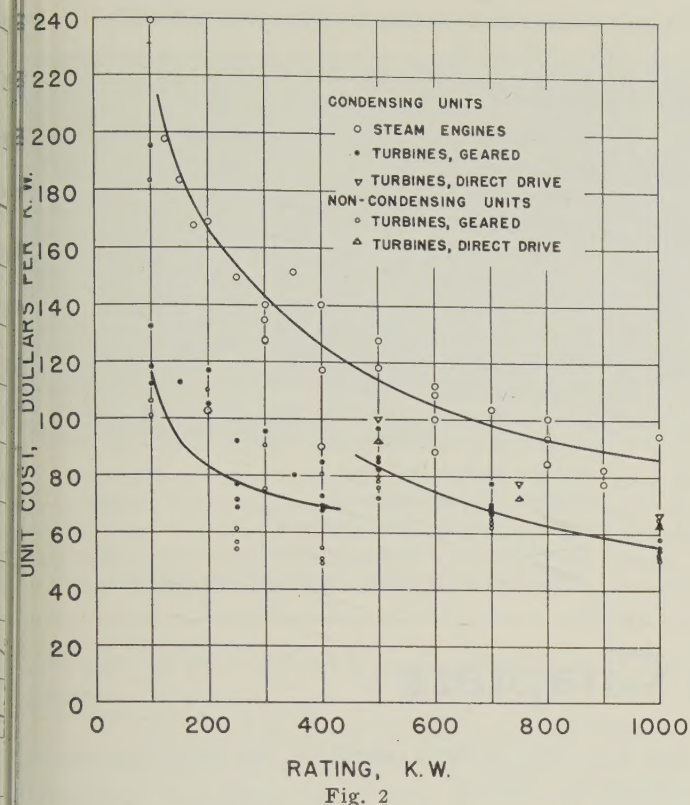


Fig. 2

as a parameter. The steam engines, even for the same builder and capacity, are subject to wide weight variations due to steam conditions and speeds. One manufacturer stated that his firm had been trying for a long time to establish the actual cost per pound for a line of steam engines. The only light thrown on this problem by the survey was found in the vertical engines. These units, characterized by light weight and high speeds, showed an almost constant cost per pound, averaging about \$0.73.

Because of the standardizing methods used in the turbine field, larger weights were frequently found with smaller capacities, rendering cost per pound data valueless.

(c) *Foundations.* Prime mover foundation costs are difficult to obtain, as the foundation for a given unit is usually contracted for locally. Turbines generally require foundations no heavier than electric motors of comparable size.

Considerations of vibration and weight call for much heavier foundations for engines than for turbines. Accordingly, an engine will be further handicapped in this respect. Fernald⁵ reported that the foundation for a 500 h.p. engine amounted to 20.7% of the engine cost.

(d) *Performance.* For the same initial and final steam conditions a well designed engine will compare favorably with a turbine in the size range under consideration. At fractional loads the engine will show greater efficiency; at overloads the turbine performs better. Strictly speaking, such a comparison is realized only with non-condensing units. The apparent equality of the two prime movers is upset as soon as high inlet tem-

peratures and pressures and/or high vacua enter the picture. The modern engine is built to operate between dry saturated steam at about 250 pounds per square inch gage, and 26 inches of mercury vacuum. As long as the engine is restricted to a single cylinder, pressure limits of this order will be required.

The turbines reported in this survey were built with inlet gage pressures from 250 to 600 pounds per square inch, with throttle temperatures up to 750° F., and back-pressures to 28 inches of mercury vacuum. These improved steam conditions have made possible the higher internal efficiencies that are reflected in the reduced rates of steam consumption.

In addition, the turbine builder can supply at no extra cost, one or more uncontrolled nozzles in the casing from which feed heating steam may be bled. The further economy made possible by even one regenerative heater again strengthens the case for the turbine. In special power applications in the industrial field it may be desirable to have oil-free bled steam for process work. Here the turbine must necessarily be chosen.

In view of the many advantages of the turbine, the field of the engine driven generator has narrowed in both capacity and in the number of units installed. It has been suggested⁶ that the attractive capacity range for the engine is from 100 to 500 kw.

V. Conclusions

- (1) First cost and space considerations favor the turbo-generator over the engine driven set, even in the small capacity range.
- (2) Modern steam pressures and temperatures and modern exhaust conditions, even in industrial power plants, are outside those best suited to condensing engines.
- (3) For equal steam conditions, and under non-condensing operation, engines and turbines will perform about equally well. The former shows better fractional load economy.
- (4) It is possible to arrange to bleed steam for feed-water heating and process use in the turbine sets, and at no additional cost.
- (5) The steam engine as a prime mover for the generation of electrical energy will find less adoption in the future. It is possible that plants now using engines may wish to continue that practice when new units are to be added. However, such a course might be dictated from secondary considerations such as operator preference and stocking of spare parts.
- (6) Many of the engine builders report that there is still a need for large Corliss engines. These units are largely replacements, however, and are intended for mine and mill service primarily.

VI. Acknowledgments

Especial thanks are due to Dr. G. A. Gaffert for his assistance in obtaining some of the information used in

this paper, and for his advice in some of the early planning. The writer is grateful to Professor A. G. Christie, of the Johns Hopkins University, for reading the manuscript and for his suggestions and criticisms.

To avoid any embarrassment on the part of the machinery builders, none of the data has been identified as to source. To acknowledge the assistance of the builders, those who contributed information or data of any sort are listed in alphabetical order in the Appendix.

VII. References

- (1) "Test of a Uniflow Engine": G. H. Barrus, Mechanical Eng., Vol. 47, 1925, pp. 440-41.
- (2) "A Life of George Westinghouse": H. G. Prout, A.S.M.E., 1921, p. 184.
- (3) Ibid., p. 206.
- (4) "Engineering of Power Plants": R. H. Fernald and G. A. Orrok, McGraw-Hill, 3rd Ed., 1927, p. 87.
- (5) Ibid., p. 78.

- (6) "Steam Power Stations": G. A. Gaffert, McGraw-Hill, 2nd Ed., 1940, p. 28.

VIII. Appendix

Information and/or data was obtained from the following companies:

Allis-Chalmers Manufacturing Company
 Ames Iron Works
 DeLaval Steam Turbine Company
 Elliott Company, Incorporated
 Erie City Iron Works
 Filer & Stowell Company
 Fulton Iron Works
 General Electric Company
 Joshua Hendy Corporation
 Nordberg Manufacturing Company
 Rollins Engine Company
 Skinner Engine Company
 Terry Steam Turbine Company
 Westinghouse Electric Corporation
 Worthington Pump & Machinery Corporation.

News From Chapters

DuKane Chapter

The regular meeting of DuKane Chapter was held at Red Lion, November 9, 1950. Forty-two members and guests enjoyed dinner at 6:30. The minutes of the October meeting were read and approved.

President Cash called attention to letter from the State Secretary requesting each chapter to propose a candidate for a Junior Representative to the Board of Direction to replace Lee Stickler who has become a Registered Engineer.

Junior members nominated included James Rakow, Paul Bloomberg and Paul E. Tanner. Mr. Bloomberg was selected by the members and his name was submitted as our chapter's candidate by letter to the State Secretary.

The Past Presidents Committee will select two nominees from the chapter candidates and will submit ballots containing these nominees' names to all Juniors, Engineers-in-Training and Students in order that they may elect their representative before the Annual Meeting.

The discussion of the \$50,000.00 campaign fund for public relations by the National Society was tabled until the December meeting.

Chapter Representative Kasser reported on the Board of Direction meeting held at Springfield on November 4th. He remarked that funds for the hiring of a Legislative Analyst are far from sufficient. Appeal was made by Chairman Drier of Legislative Analyst Committee for DuKane members to continue contributions.

Mr. Kasser also reported that plans for the Annual Meeting at Urbana on February 1, 2 and 3 were discussed by the Board. Tentative program includes a "get-together" on Thursday, February 1; business sessions on Friday, and speakers on Saturday, February 3rd.

The Nominating Committee, Gus Duechler, Ray Wat-

son and Cliff Ashley, submitted the following slate of officers for 1951:

President—John Bateman
 Vice-President—Doug Dreier.
 Secretary-Treasurer—W. A. Rakow
 Chapter Representative—Robert Roy.

W. Rakow declined to be a candidate for reelection and George Booth was nominated from the floor as candidate for secretary-treasurer. Other candidates' names will be submitted by chapter members at the election which will be held in the December meeting.

The door prize was won by George Bohlig and the treasury inflated to the tune of \$8.25.

The business session concluded at 8:10 p. m.

A tour through the "Shakeproof division" of the Illinois Tool Works as arranged by Program Chairman George Booth followed. The members were escorted through the plant in small groups by supervisors and trained personnel to observe the processing of several types and sizes of screws from raw wire to the finished product. After the tour, refreshments were served in the plant cafeteria by the management. Mr. Gene Fuller, Shakeproof Division manager, welcomed the Engineers of the DuKane Chapter.

Mr. Cash thanked Mr. Fuller and the management for the hospitable and educational evening.

October Meeting

The regular meeting of DuKane Chapter was held at Red Lion, October 12, 1950. Vice-President Bateman presided. Fifteen members and three guests in attendance. Minutes of the meeting of September 14th were read and approved.

Doug Dreier spoke on the fund for Legislative Analysts and urged those who intended to contribute to do so as soon as possible. V. H. Kasser urged all members to

GUESTS' AND SPEAKERS' TABLE AT THE OCTOBER MEETING OF THE CENTRAL ILLINOIS CHAPTER



From left to right in the above photograph—F. E. Troxel, Secretary, Central Illinois Chapter; P. E. Roberts, Assistant Secretary; J. A. Askren, President, Central Illinois Chapter; Alex Van Praag, Past President, I. S. P. E.; G. E. Ekblaw, President, I. S. P. E.; James Whelan, Past President, I. S. P. E.; E. E. Cooper, Past President, I. S. P. E.; W. A. Oliver, National Director and Editor, Illinois Engineer; and H. W. Dorn, Vice-President, Central Illinois Chapter. President Ekblaw was speaker of the evening. The picture was made available through the courtesy of N. Kessler, Chairman, Public Relations Committee, Central Illinois Chapter.

take part in the Civil Defense program in their communities.

A. W. Beineke and A. H. Hampton of the International Harvester Company office at Aurora were then introduced and presented a very interesting program including three motion pictures, two of which demonstrated late developments of agricultural machinery and the third had to do with an African expedition.

Donations totaling \$9.00 were received from those present, half of which was presented to the holder of the lucky receipt, Gene Tanner. Meeting adjourned.

W. A. RAKOW, *Secretary*

Egyptian Chapter

The chapter met on Oct. 24, 1950 at Jackson Country Club, near Murphysboro, for dinner, with the following present:

Members: Hindman, Owen, Meisenheimer, Baker, Brock, Riseling, C. L. Smith, Blankenship, Harris, Schultz, Cromeenes, Burnett, Kerwath, Persson.

Guests: Mr. Sam Carrothers, Mr. Harold J. Blank, Mr. C. K. Gibbon, Mr. Louis Segar.

President T. O. Cromeenes presided at the business meeting. He called to the members' attention the recent revision in the I. S. P. E. minimum pay schedules, eliminating any expressions that could be considered coercive or mandatory. He also spoke concerning action by the National Society of Professional Engineers in connection with recent publicity concerning military deferments for professional men.

Program Chairman Kerwath reported on our August picnic, attended by about 80 engineers, at which great quantities of fish, ham, and beer were disposed of and "parlor games" played.

It was decided that our next regular meeting will be on January 9, 1951, at which time the movie of the All-Star Football Game of last August will be shown.

The Membership Committee reported several applications in prospect, both new and for reinstatement.

Since the January 9th meeting will be an annual meeting, officers for 1951 must be elected then. President Cromeenes appointed as a Nominating Committee the three immediate past presidents, members Keen, Riseling, and Lee.

The meeting was then turned over to Program Chairman Kerwath, who introduced the speaker of the evening, Mr. H. A. Spafford of Springfield, chairman of the I. S. P. E. State Legislative Analyst Committee. Mr. Spafford made a very effective presentation of the challenge to our Society to furnish new service to professional engineers sufficient to increase membership above the present 10% and to forestall professional unions. Mr. Spafford suggested an active legislative program, because legislation is of vital importance to engineers. His committee has the task of raising \$8,000 by voluntary contribution for employment during the next legislature of a legislative analyst. Those present were interested and a lively discussion developed.

It was decided that a special meeting should be held in November to decide on the chapter attitude.

After adjournment of the meeting, Mr. Kerwath showed a very interesting film on highway safety.

J. L. BURNETT, *Secretary*

Champaign County Chapter

Members and guests met at 6:15 p. m. Oct. 5, 1950, at the University Club, Urbana, Illinois. There were 57 members and guests present.

After dinner President Anderson called the meeting to order and asked for the introduction of guests. Among the guests were nine University of Illinois engineering students. Each student is the president of one of the local engineering societies.

Mr. W. A. Oliver gave a short talk on the history, aims, and accomplishments of I. S. P. E. and N. S. P. E.

Mr. Halsey then reported the results of voting on a new name for the chapter:

Founders' Chapter	33
University	2
Miscellaneous name	4
Opposed to changing name.....	5
	—

Total votes cast..... 44

The Secretary read the minutes for the July 6 and September 7 meeting. There being no objection, the minutes stood as read.

Mr. P. E. Roberts reported that there would be a Professional Engineering Refresher Course.

Mr. Dietz asked who would represent the I. S. P. E. at the Chicago meeting of the National Council of State Board Examiners.

Mr. Ekblaw, President of I. S. P. E., stated that the Society had three members on the Illinois State Board. He said that he planned to ask Mr. Wallan to sit in on the meetings.

Mr. Muirheid then introduced Mr. R. C. Hay, Associated Professor of Soil Conservation, who gave an interesting talk on the Illinois Soil Conservation program.

The meeting adjourned at 9:15 p. m.

J. W. BRISCOE, *Secretary*

Madison County Chapter

A regular monthly meeting was held August 8, 1950 at the Alton Plant of the Russell Miller Milling Co., with ladies invited to make a tour of the flour mill in operation. During a short business session called to order by vice-President Shanahan, minutes of the previous meeting were read and approved. The secretary was directed to publicize the refresher course to be offered in time for the November examination.

Our guides, Mr. Ryan and Mr. Rynearson, took us to the ninth floor of the new mill building, which is of "slip-form" reinforced concrete design. Following "gravity flow" from floor to floor, the group observed facilities for storing, grinding, sifting, blending, and packaging the product. (President Flagg joined the party at the fifth floor, having been unable to attend earlier.)

Last, but not least, we were led to the laboratory, where bread and cakes are made and tested as a regular part of the business. Further refreshments in the form of "cokes" and jugs of hot coffee were also provided by our hosts.

September Meeting

After a two-weeks postponement, our September meeting was held on Sept. 26, 1950, at the plant of Alton Water Company, through which we were conducted by Manager King.

Vice-President Shanahan presided at the business session following the tour. An informal discussion of the Civil Defense set-up pointed out the importance of engineers.

Minutes of the previous meeting were read and approved.

Mr. Willis presented a letter drafted by the Legislative Analyst Committee, which was to be mailed to the members.

Mr. Thatcher suggested the possibility of getting more members from the Tri-Cities area.

Meeting was promptly adjourned at the sight of solid refreshments provided by our host.

October Meeting

On October 10, 1950, a regular meeting was called to order by President Flagg in the Quonset Building of the Shell Refinery at Roxana.

Minutes of the previous meeting were read and approved.

A specimen publicity release from the National Society was read, on the subject of Civil Defense.

Mr. Willis reported the Legislative Analyst Committee ready "to pass the hat" for cash, checks, or "firm pledges" to be paid to the Legislative Analyst Fund by Jan. 1, 1951.

Mr. Shanahan of the Civil Defense (formerly Military Affairs) Committee spoke of civil engineer jobs with the Navy, for young engineers who are not necessarily graduates.

Mr. Graham spoke of plans for the November and December meetings, then presented three young men who, in turn, held the attention of the 18 members and guests present with talks about their respective hobbies.

S. W. Woods' son Stanley showed model airplanes, locomotive and tender, and other examples of wood carving, and the variety of special blades with which they are done.

J. D. Voorhees' son Phil demonstrated various knots, hitches, and rope splices, with accompanying commentary on their use.

M. L. Graham's nephew, David Ford, presented a sky map for the evening, pointing out the planets, stars, constellations, and nebulae of special interest.

President Flagg thanked the boys with appropriate comments on their status as future engineers. Reminiscing over an incident of his days at University of Illinois, Mr. Flagg then introduced his former classmate "Skeet" Roberts, Assistant Secretary of the State Society.

Mr. Roberts emphasized the importance of getting plenty of young men in our chapter, and suggested that we use the roster of last year's refresher course given in Granite City, as a list of potential "Engineers-in-Training."

Dr. George E. Ekblaw, State President, referred to the Society as his "hobby." He spoke of the various State committees and their duties, with special emphasis on the need for promotional efforts by all members.

Dr. Ekblaw and Mr. Roberts then answered several questions, and Mr. Roberts announced the dates of the next Annual Meeting, Feb. 1, 2, 3, 1951.

Following announcement of additional committee appointments, the meeting adjourned.

L. K. MEYER, *Secretary*

Kewanee Chapter

The October 17, 1950 meeting of Kewanee Chapter, S. P. E., was called to order by Vice-President Osborn following dinner at the Tasty Grille in Galesburg. The reading of the minutes of the previous meeting was dispensed with, and following the report of the Program Committee there was some discussion regarding the starting time of the meetings. Upon motion by Mr. Dahlberg, seconded by Mr. Webeck and unanimously approved, it was agreed that meetings would be scheduled for 6:45, and that starting time would be adhered to. Mr. Weber requested cooperation with the work of the Legislative Analyst Committee, and indicated that his committee would be heard from at a later date. Mr. Osborn then appointed Messrs. Fulper, Bates and Weimer to the Nominating Committee with instructions to report at the November meeting. There being no further business, the meeting was turned over to Mr. Weeber, who introduced the speaker of the evening, Mr. H. A. Spafford of Springfield, State Chairman of the Legislative Analyst Committee.

Mr. Spafford reviewed the background of the legislative work of the Society, and presented a very forceful and logical case for the procurement of a legislative analyst. He indicated that while he didn't believe it to be the answer to all of our problems, or necessarily the best solution, it was at least an immediate step in the proper direction. Following Mr. Spafford's presentation of the program proposed by the state committee, there was considerable discussion from the floor. Mr. Pappemeier moved, seconded by Mr. Weimer, that the chapter go on record as favoring a voluntary contribution by chapter members of amounts of at least \$5.00 for those having an annual income in excess of \$5,000.00 to be used for the purposes of financing the cost of a legislative analyst and/or the expenses thereof. Motion was unanimously approved.

Meeting was adjourned at 10:00 p. m.

A. D. SPICER, *Secretary*

Lake County Chapter

The regular monthly meeting of the Lake County Chapter of the Illinois Society of Professional Engineers was held Wednesday, November 15, 1950, at the Swedish Glee Club. Dinner was served to 65 members and guests.

The business meeting was called to order at 8:15 p. m. by President Simonson. Minutes of the October 17th meeting were read and approved.

Secretary Jaeschke gave a brief summary of the services offered by Engineering Societies Personnel Service, Inc. and distributed copies of the bulletins outlining available positions in the engineering field.

Mr. Amstutz reported that the Lake County Zoning group has not advanced adequately in their survey to call upon the services of engineers in this area.

President Simonson made mention of the questionnaire concerning programs offered which was sent out to members along with notices of this meeting, adding that a

number have been returned and will be studied by the Program Committee.

President Simonson stated that a recent ruling of the Massachusetts Supreme Court necessitated deletion of statement having to do with non-compliance of the schedule of fees and salaries as being unethical. Henceforth, the Schedule of Fees and Salaries is recommended—not prescribed—since the latter borders on collusion.

Mr. William Hooper was thanked by President Simonson for the excellent job done in conducting the recently completed Refresher Course. Mr. Hooper stated that this Society should become more active with such local problems as zoning, city planning and a new building ordinance, adding that the Society should offer its services since those boards need technical assistance.

President Simonson read R. E. Anderson's report of the Board of Directors meeting held last Nov. 4th. The highlights and the action taken were:

- (a) Notify local industries of the time and place of the State meeting.
- (b) Recommend a Junior Member for the Board of Direction. Lake County Chapter has no one qualified at present.
- (c) Appoint an Engineering Counsellor for Lake County. Dave Miller was appointed by President Simonson.
- (d) Get new advertising contracts for 1951.
- (e) Members in arrearages. The Secretary was instructed to prepare a list and submit to the Membership Committee for action.
- (f) Engineers' Week will be the week of Washington's Birthday. The Secretary was requested to obtain a kit from Assistant State Secretary Roberts.
- (g) The Examining Board desires names of individuals who can qualify as members of that board.
- (h) A brief summary of the coming State meeting.
- (i) Poor response to date from the chapters concerning the proposed position of Legislative Analyst.

Secretary Jaeschke was instructed to obtain Certificates of Membership from State Secretary Roberts.

President Simonson appointed the following members to serve as a Nominating Committee to name a slate of officers for the next year: David R. Miller, chairman, E. F. Needham, L. C. Domke, and R. L. Thacker.

Henry Bleck introduced two of Lake County's Representatives in the State Legislature, Harvey Pearson and Robert McClory. Representative Pearson stated he did not believe the appointment of a Legislative Analyst would serve a good purpose. Representative McClory stated that he expected to receive numerous letters of a complaining nature, but that he most desired help of the sort which will make him a better legislator.

President Simonson announced that with President Truman signing the Engineers' Registration Law for the District of Columbia, all States and Territories of the United States now have a Registration Law.

Program Chairman Cy Drew introduced W. B. McClelland of the Clark Equipment Company, who dis-

cussed "What the Buyer Should Know When Purchasing Materials Handling Equipment." Preceding this talk was a movie showing how Ford trucks serve the many industries in the Fairfax industrial area adjoining Kansas City, Missouri.

The meeting was adjourned at 10:20 p. m.

E. A. JAESCHKE, *Secretary*

Central Illinois Chapter

The October 26, 1950 meeting of the Central Illinois Chapter of the Illinois Society of Professional Engineers was held in the American Legion Hall, with 37 members and guests in attendance.

Immediately following the dinner, Walter G. Scherer, Program chairman, introduced the speaker of the evening, Dr. Lloyd Dodd, a Decatur dentist and former president of the Illinois Dental Society. His talk dealt in a large part on the importance of a professional society establishing good public relations in as many ways as possible.

Out of a total of 84,000 dentists in the United States, the American Dental Society has a membership of 75,000, or 89%. This is an extremely high percentage, and should give us a good mark to shoot at. In answer to our question as to how this high membership is attained, Dr. Dodd stated that they contact every new prospect personally and do the best job they can on educating him on what the society means to its members, and to the entire profession. Socialized medicine was discussed in many of its phases and some very good reasons were given why doctors in general are so very much opposed to it.

The discussion period following the talk filled up our entire meeting time so that we adjourned at 9:30 p. m. without transacting the usual business.

November Meeting

The rerouting of Highway 36, our main east and west route through Decatur, turned out to be a subject for much discussion at the November 16, 1950 meeting of the Illinois Society of Professional Engineers. Mr. John M. Weir, city engineer and one of our chapter members, presented this subject in a very effective manner with a complete set of maps and charts. After a lengthy discussion Mr. Weir stated that the lack of city and state funds for highway improvements was a serious handicap and that the proposed increase in gas tax would help materially to get some much needed improvements made.

Motion was made by Floyd Birt, seconded and carried, that the president appoint a committee to study the question of increasing the state gasoline tax and report at the next meeting. The following committee was appointed: Floyd Birt, chairman, Chris Greanias, Edwin O. Crawford and E. A. Pettitt.

Nominations for the slate of new officers for 1951 were presented by John R. Gardner as follows:

For President—Dr. Herman W. Dorn

For Vice-President—Barclay F. Behrendt

For Director—John F. Sweetnam

For Chapter Representative (none secured).

The name of John R. Gardner was presented from the floor by J. L. Howie as the nominee for Chapter Representative.

A letter written to the State Board of Direction by President John Askren was read by the secretary, presenting Duane R. Chicoine as our nominee for Junior member on the State Board of Direction, and giving good recommendation as to his experience and background to fit him for this office. Motion was made, seconded and carried, that the chapter approve the action of the Board in presenting Mr. Chicoine as a candidate.

Mr. Howie called attention to the fact that the Junior Board member has proved to be a valuable asset to the State Board, and proposed that the Junior members of our local chapter select one of their number to act as Junior member on our own Board of Direction. Motion was made, seconded and carried, and at the end of the meeting the name of Robert E. Schwartz was presented for this office.

Mr. A. W. Neureuther stated that a letter will soon be sent out from the state office asking for contribution for the support of a full-time Legislative Analyst.

President John Askren explained that our local secretary is now receiving weekly bulletins from the Engineering Societies Personnel Service, Inc. which contain a large list of engineering positions available. These bulletins are available to any members who care to use them. The current issue of the Illinois Engineer contains a full page of such positions.

On account of the holiday season, it was decided to hold our December meeting on Thursday evening, December 21st. The meeting adjourned at 9:30 p. m. There were 36 members and guests present.

FLOYD E. TROXEL, *Secretary*

Joliet Chapter

The regular November meeting of the Joliet Engineers' Club was held Tuesday, November 21, 1950, at "Little Jack's" with 26 members and 20 guests present.

Following dinner, the meeting was called to order at 8:00 p. m. by Vice-President Gray.

Members and guests were then self-introduced.

The minutes of the October meeting were read and approved.

No old business was presented.

Under new business, Chaney reported that a letter had been written to the Army Command of this area, asking for information in regard to civil defense plans. His answer is on file and refers the committee to the mayor of Joliet.

Vice-President Gray informed the membership of the forthcoming campaign on the part of the National Society for funds to promote better public relations.

William Chaney introduced the speaker of the evening, Mr. H. A. Spafford of Capital Chapter, who spoke in favor of contributing funds for the purpose of the State Society hiring a Legislative Analyst.

Following the talk, President Seiberling called on the following for personal viewpoints: J. Whalen, F. Campbell, F. Schundler, H. Eggens, L. Seron and C. N. Lusty. Following the remarks the subject was dropped until later.

The program was concluded with the showing of a colored motion picture entitled "Rail Steel in the World of Today."

Meeting adjourned at 10:20 p. m.

F. H. TITTSWORTH, *Secretary*

Rock River Chapter

The meeting was called to order by President B. C. Taylor on Nov. 10, 1950 at 8:25 p. m., at the Elks Club in Dixon. A meeting of the Executive Committee with the chairmen of the chapter committees had been held previously to the chapter meeting.

The minutes of the meeting of September 8 were read and approved. Mr. C. E. Johnson reported for the Membership Committee, and Mr. R. H. Anderson reported for the Committee on Civil Defense.

A letter from Mr. P. E. Roberts, Assistant Secretary of the Society, dated October 20, and regarding fees and salaries, was read by the secretary, who also reported concerning the availability of the Engineering Societies Personnel Service, Incorporated. The lists of jobs and applicants furnished to the chapter weekly are available from the secretary, for members of the Society and chapter.

Mr. H. F. Walder reported on the work of the Legislative Analyst Committee, and appealed to all members to send in their contributions. Mr. C. K. Willett noted that Mr. Arthur M. Kaindl, a member of the Society, was defeated in the November 7 election, and suggested that he might be receptive to a proposition regarding the Legislative Analyst job.

Mr. Taylor reported concerning the Public Relations efforts of the N. S. P. E. Mr. Anderson reported on the meeting of the Board of Direction.

The next meeting of the chapter will be on January 12, 1951.

President Taylor appointed Mr. G. D. Bort to prepare and present resolutions regarding the passing away of two members of this chapter, Mr. R. L. Schoenberger of Princeton and Mr. J. M. Martin of Dixon.

There being no further business, the meeting was turned over to Mr. W. O. Anthony, who had prepared a program of movies, which was very much enjoyed by those present. The first movie was "An Orchid to Mr. Jordan" and dealt with the story of Stainless Steel. It was produced by U. S. Steel Corporation. The second movie was entitled "Magic in the Air" and was a simple story of the basic principles of television. It was produced by General Motors Corporation.

The meeting was adjourned at 9:25 p. m., and was followed by refreshments and the usual social hour.

A. H. FERGER, *Secretary*

Madison County Chapter

November meeting of the Madison County Chapter was held at the Edwardsville Gun Club, Nov. 14, 1950. In addition to sixteen older members, Lee Schlemer was present as a member for the first time. Guests introduced were Mr. Jess Smith, Materials Testing Engineer, and Mr. Ed. Kane, State President of the A. I. A.

W. E. Willis reported successful prosecution of the Legislative Analyst Fund Campaign which, after simmering for two months, is now being "brought to a boil."

Program Chairman Graham announced plans for the coal mine tour later this month, and the annual dinner meeting of members, wives, and friends in December.

President Flagg spoke of the National Society's Publicity Campaign, in the absence of Public Affairs Chairman Jehle.

The Civil Defense Committee report by Chairman Shanahan led to a motion that we charge the Civil Defense Committee to furnish a list of chapter members, with their qualifications, for the use of the local Defense Committees throughout the Madison County area. This motion was seconded and carried. Mention was made of a course in First Aid for Atomic Injuries, to be started in January at Shurtleff College in Alton.

The annual election of officers, to serve during 1951, produced the following results:

President: Geo. Shanahan.

Vice-President: Chas. Graves.

Secretary-Treasurer: Lester Meyer.

Executive Committee: Mal Graham, Chas. Bloom, Art Adams.

Walter Willis continues with another year to go as Chapter Representative.

Following election of officers, the meeting adjourned.

* * *

At 2 p. m. on Saturday afternoon, Nov. 25, 1950, Members Willis and Adamson conducted eight other members of Madison County Chapter on a tour of the new slope mine operated by Lumaghi Coal Company near Collinsville.

The complete mechanical cycle of undercutting, drilling, shooting, loading, and timbering was observed at close range. Part of the mine uses equipment rolling on narrow-gauge track with trolley; the other side is worked with pneumatic-tired machinery, carrying several hundred feet of electric cable on a reel.

The operation of the coal washer was left for another time.

L. K. MEYER, *Secretary*

This country would not amount to as much as it does if the young men of fifty years ago had been afraid that they might earn more than they were paid for.

—Thomas A. Edison

Shun idleness; it is a rust that attaches itself to the most brilliant metals.

—Voltaire

REPORT OF NATIONAL DIRECTOR

(Continued from page 4)

non-professional duties and even routine tasks. At the same time there were instances where professional responsibilities were thrust upon unqualified individuals. Every effort should and must be made to prevent such waste in future military mobilizations.

The primary responsibility for resolving the problems involved must rest with the personnel classification system of the armed services. Therefore, it appears essential that the armed services establish policy boards or review boards or both. These should be composed of professionally qualified officers of high rank who would be given adequate authority to establish policies, to investigate or cause to be investigated the apparent misuse of professional personnel, to recommend transfers of such professional personnel to appropriate professional assignments, to recommend transfers of non-qualified personnel from assignments requiring professional qualifications and to perform such other duties as the armed services may feel will enhance the basic policy of the most effective utilization of the professional personnel in the armed services.

Mobilization of Professional Talent in Civilian Services

It is a basic requirement that the factories, the plants and the research organizations devoting their primary effort to military production must have first call upon the best available professional talent and technical skill. During maximum military mobilization there will soon develop a shortage of technically qualified personnel in certain fields. Those who are best qualified to serve the national defense material production must not be allowed to be used for the less essential production of goods of the furnishing of services or the continuation of research for the needs of the civil population.

In the past it has not been necessary to establish any procedure for the involuntary assignment of professional personnel in civilian occupations concerned with the needs of the civil population. Past periods of national emergency have relied upon voluntary means to place the best personnel in the essential jobs. It is believed that the voluntary program should be continued until and unless future events begin to develop such acute shortages of technically competent individuals in the national defense production program. At such a time it may conceivably be necessary to impose some form of control by the Federal government over the assignment of technical personnel to specific tasks. Unless and until such control proves necessary, the engineering profession should cooperate to resolve the issues through its voluntary organizations.

Any system for the allocation of professional personnel in technical work must rest upon the broad knowledge and detailed appreciation of the individuals having the desired talents, and the detailed knowledge of their individual experience, individual abilities and individual capabilities. The rosters of scientific personnel and of professional personnel used in World War II should be brought up to date, kept up to date and improved immediately. The engineering profession and all other scientific professions should do everything possible to support the Federal government's effort to develop and maintain an adequate and improved roster of their personnel.

Balancing Military Needs Against Defense Production Needs

It is axiomatic that the armed forces cannot accomplish their mission without personnel and material and logistical equipment. These interests require a fine balance which will utilize the available resources to the ultimate.

The decision to induct or not to induct an individual into the armed forces should rest on the answer to only one question. It is, in which location will the individual in question provide the most useful service to the total national defense effort?

The decision should be made on the basis of the above stated criterion and not on the basis of the desire of the individual or the inconvenience to the individual or others. For example, it would be the height of folly to draw into the armed forces a highly

skilled engineer working in a civilian capacity on the improvement of guided missiles. On the other hand there should be no reason to defer a professional engineer engaged in the development of the production of a purely civilian-luxury item.

It is realized that few cases will be so clearly defined and is therefore necessary to establish an appropriate procedure for the very best answers to these questions.

It appears desirable that the appropriate agencies of the Federal government establish a national review authority to consider applications for deferment from military service on the basis of employment in civilian research or civilian production having a direct relationship to the national defense effort. The question arising under these conditions cannot be satisfactorily resolved by local selective service boards under the present Selective Service Act of 1942, as amended, because of the inherent limitations of the personnel of the individual Selective Service Boards. The proposed review board should be composed of outstanding and eminent engineers and scientists and others having a detailed knowledge of the technical problems involved, an understanding of the situation and broad experience in industrial research and industrial production.

The proposed review board should also be limited in its action in response to the single question of the capacity in which the individual in question may make the most important contribution to the national defense effort.

Applications to the review board for deferment from military service should originate from employers and from others bearing a similar relationship to the individual for whom deferment is being requested. The application should set forth clearly the specific and the detailed reasons for requesting the deferment. The applications should be made under oath of correctness under penalty of committing perjury and should be surrounded with such other safeguards which may be considered desirable to insure that only those individuals meeting the strictest tests should be permitted to remain in civilian occupations in preference to being sent to the armed forces. Any deferment granted upon the approval of an appropriate application should be continued only as long as the individual to whom it pertains is retained on the defense effort for which the application was approved.

Future Supply of Technical Personnel in Extended Mobilization Periods

The resources of technically skilled personnel in the United States came dangerously close to depletion during World War I. This resulted from the requirement of a five-year interval necessary to educate and train and graduate students in technical curricula and to give them some experience. The shortage of graduates in engineering curricula and in science curricula has been largely overcome, but there is today a definite shortage of trained engineers. Thus, even before widespread mobilization is in progress the policies pursued during World War II are already being felt. It may be possible to meet the present limited emergency with the presently available professional personnel skilled in engineering and in science, but the lack of adequate experience of the graduates of the 1946-1950 period is already manifest.

It is possible that the disastrous effects of this shortage of skilled professional personnel may not be harmful for a short time. However, present unsettled world conditions make it hazardous to assume that the current emergency will be of short duration. Leading authorities caution us to look forward to a generation, that is about 30 years, of stress and strain in international relations, subject at any moment to an outburst into total war. Under such conditions it is imperative that plans be made for a continuous and sustained flow of trained engineers and trained scientists from colleges and schools and universities.

The outstanding problem presented by this situation is the realization that these same individuals are in the age bracket considered most suited for service in the armed forces. So, a suitable balance must be developed and maintained between these two requirements of present-day conditions.

A careful study of this important phase of the situation should be made by the appropriate Federal government agencies in consultation with representatives of engineering organizations, scientific organizations and the educators concerned with the imparting of knowledge to students pursuing those curricula. It is recognized that it will be necessary to resolve many details for an adequate policy to be developed in this field but, on a broad basis, it is believed that a suitable start may be made by recognizing that a maximum number of engineering students and science students must be deferred from military service and allowed to complete their formal education. It is also believed that upon graduation a reasonable time should be allowed for acquiring the necessary experience to appropriately utilize the education acquired. The number of students and graduates deferred on the basis of the reasoning just given should be based on an agreed percentage of the number of such students and graduates enrolled or having been graduated from accredited engineering curricula and science curricula. The percentage should be based on a continuing study made by an appropriate manpower mobilization organization composed of Federal government agency representatives and representatives of engineering organizations, science organizations, engineering schools and science schools. Besides, the percentage should be revised at intervals dependent upon conditions applying and those deferred should be the individuals with the highest scholastic and professional standing within the limitation of the applicable percentage.

REVIEW AND PREVIEW

C. A. MARCOWKA

From Milwaukee Engineering

It's now a long time since 1929, but people still ask the question: Exactly what was it that caused the big crash of '29 and the subsequent depression? The snap answer, "Hoover and the Republicans," has lost favor with many long ago and the question instead of becoming a dead issue is providing much food for thought nowadays.

People remember many events that accompanied the start of that great depression: a precipitous stock market plunge, runs on banks, creditors wiped out along with the debtors, thousands facing suddenly a bleak, empty future. There were panic, riots, and hunger marches.

It took some time for people to recover at least partially from the shock. During the ensuing years there came along many kinds of doctors, all offering their special remedies. Wall Street had a part in it. Give it a shot of SEC. Mortgage foreclosures had a part in it. Cover mortgages with government insurance. Runs on banks had a part in it. Close the banks when deemed necessary. Remedies there were many but they were all for the symptoms.

In this people's government the people were never to be searched for the answer. That wouldn't be popular. One political party pointed its finger at the other. The people liked that and the reformers were in the saddle. Forgotten was the long inflationary rise, fired by over-extended credit used recklessly, and forgotten was the over-production to meet big demands by buyers with big credit and little cash. Every merchant became a banker. Credit? Sure. Collateral? Don't be silly . . . your credit is good. Right at this point it would be easy to blame the fellow who invented buying on installment payments.

It would be easy to do that, easy and popular, since it would turn the finger from us, the people. Someone left the door open but we, the people, unthinking, walked in. It was simple to buy stocks, real estate, commodities of all sorts, and to sell a short time later at a profit.

Unthinking we were of the fact that an accumulation of installment payments tightly mortgages our future and that, along with the joyride, comes a higher cost of living to consume the balance of our pay check. Unthinking we were of the fact that a higher cost of living makes people ask for higher money wages because they "need" them, not because their productivity warrants it. Unthinking we were of the fact that owners of goods, seeing the value of dollars watered down by payment of more dollars for identical services, were asking more for their goods, and perhaps a little bit extra as a hedge against tomorrow's costs. The trend set in ran its course, and stopped at its inevitable, catastrophic climax.

Here we are in the year 1950, wondering whether history can teach us anything. Some of us go about saying that it can't happen again. All the disaster producing loopholes have been plugged up and the government stands ready to help us with all our economic difficulties.

There is the FDIC for those who want to make safe their bank deposits and their paid-up shares. There is the RFC with a handy loan for your business venture. There is the CCC with a convenient subsidy for your farming venture. There is Social Security for all of us in our old age.

These things don't simply drop from heaven. They're being paid for by us, the people, in some ways known to us, and in many ways unknown to us. If hidden taxes could only talk! But even direct taxes with their painless installments have lost their compelling power to make people scrutinize the goings on.

Tax money doesn't even pass through our wallets any more and people fail to assess fully both the size of their income and the size of their check-off income tax. The tax has been accepted as a permanent mortgage upon our future, but it need not require sacrifices on our part if we demand and get that higher money wage, we tell ourselves. Inflationary procedure? Oh, yes, but we'll try not to over do it. . . .

During the five years of respite from hot war nothing could be done to turn back the tide of government spending. Instead we continued to go into debt faster than we could find new revenues. It wouldn't do to raise the taxes much higher to cover the deficits. Voters don't like higher taxes and anyway there are a sufficient number of people still willing to buy government bonds at atrociously low interest rates because they say: "Government's credit is good and its bonds are safest. What else would be worth anything were the government to become insolvent?" A naive question whose full import is not fully appreciated by most who resort to it as an escape-ment.

Government bonds are just another way of paying tomorrow for goods received today or yesterday and, in

some cases, already used up, scrapped or declared surplus. A business institution with ways and means for making a profit can usually justify the floating of a bond issue on a self-liquidating basis but the government can only raise taxes or redeem one bond issue for another when the maturity date arrives.

Shades of 1929! Not only are the merchants bankers again but the country is liberally sprinkled with government credit corporations, bankers of another sort. The government now takes the risk but fails to balance its own budget in the most prosperous years of its history.

Lightning rods have been placed over the institutions which led the previous downfall. What sort of lightning rod does the government need?

Out of the panic of '29 people still saw a glimmer of hope. The government was still there with a plan, of a sort, to bring order out of confusion.

Can this government itself become insolvent? That is a question few prophets would dare to treat lightly. The important thing is this: The people are the government. No chance to point fingers. If you don't like what you see, now is the time to think and act. Good government is up to you.

HIGHPOINTS FROM THE LAST N. S. P. E. LEGISLATIVE BULLETIN

D. C. Registration Bill

With the stroke of the Presidential pen the District of Columbia obtained an engineering registration law. The last legislative hurdle was completed and the legislation to establish a registration law for the only area of the United States without such a law was sent to the White House.

After years of effort by D. C. engineers to obtain a registration law the sequence of events brought the campaign to a rapid conclusion. The Senate passed the measure on July 26th and this was followed by approval of the House District Committee and the House of Representatives within one month. There was a minor difference in wording between the two bills and this was adjusted on September 11th when Representative John L. McMillan (D., S. C.), chairman of the House District Committee, obtained unanimous consent to lay aside the House bill and accept the number and wording of the Senate bill. (S. 3555.)

Engineer References Deleted in Special Medical Draft

Special emergency legislation has been approved to provide for the drafting of doctors and dentists up to the age of 50 in light of the severe shortage of such personnel in the armed forces. The legislation also permits the special drafting of professional personnel allied to doctors and dentists. It was this provision which led to the interest of the engineering profession. One of the earlier drafts of the bill defined "allied specialists" to include sanitary engineers and industrial engineers. The final version, however, as sent to the President, elimi-

nates the reference to engineering personnel and the wording of the conference report indicates that the intent is to include only specialists allied directly to doctors and dentists. (S. 4029.)

During the course of debate and action on the bill there were reports that a backstage struggle was taking place between the Defense Department and the National Security Resources Board over the question of which agency would control the mobilization status of scientific and professional personnel. Presumably the draft of the bill containing a broad listing of "allied" specialists was to give the Defense Department jurisdiction over the mobilization status of such persons. The NSRB was reported, however, to have opposed this move and had recommended that control of such allied personnel be given to the President. The report states that in view of this conflict the language was changed to cover only those identified with the healing professions.

Regarding the broad question of draft and deferments it should be noted that the list of critical occupations prepared by the Department of Labor for the Defense Department includes engineers of all branches. Being on the critical list by occupation will not be sufficient by itself to justify deferment, however. The individual will also have to meet basic conditions of employment in a capacity which makes the work involved essential to the national defense.

Point Four Under Way

The program of technical assistance to underdeveloped nations is now officially under way following final Congressional action on appropriations and the Presidential order delegating responsibility for carrying out the law to the Secretary of State.

Appropriations for the program survived several narrow squeaks and it was only after a last-minute appeal by the President that Congress restored the funds previously cut. The Senate-House conferees had cut the appropriation to 15 million but this was rejected by the House and Senate in favor of \$26,900,000. Other funds already available for technical assistance work in Latin America and South America raise the total available funds for the fiscal year to \$34,500,000.

The Presidential order supports the previous understandings that the program for the first year will primarily be organization and planning with actual program activity concentrated on training. The President said that the U. S. funds will be used to a large extent to provide technical assistance by sending experts abroad and to bring qualified trainees to this country.

A large part of the fund will go to the United Nations technical assistance program with which the U. S. program will be coordinated. The President said that as the U. N. program progresses more and more of the work will be carried out by the international agency. He highly praised the idea of the Point Four program and indicated that he thought it would be a potent weapon against Communism by promoting health and raising the standards of living of the people of the world.

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Sixty-sixth Annual Meeting

Illinois Society of Professional Engineers

Champaign-Urbana

February 1, 2 and 3, 1951

FRANK J. KRAMER LEAVES NORTH SHORE LINE

Mr. Frank J. Kramer, Member and Past President of Lake County Chapter, has recently retired from his position as Superintendent of Way, Structures and Power of the Chicago, North Shore and Milwaukee Railroad Company where he has served for thirty-five years. Mr. Kramer plans a long vacation in Florida after which he'll "begin thinking about work again."

The members of the Illinois Society wish him every success in his new undertakings.

NATIONALIZATION NOTE

How bureaucracy can grow is illustrated by Britain's experience in its nationalization of commercial highway transportation. In five years it has mushroomed from a five-man Road Haulage Executive Board to a complex organization of 70,000 persons, with eight division offices, thirty-one district offices, and between 300 and 400 local offices as more trucks were taken over. The industry's official journal can't keep up with the growth. The latest issue gave the size of the staff as 60,000, but a Road Haulage Executive spokesman explained, "That was as of January. It's 70,000 now."

Men show their character in nothing more clearly than by what they think laughable.

—Goethe

PROFESSIONAL EXAMINATIONS

The November 1948 and the May 1949 State of Illinois Department of Registration and Education examinations for registered professional engineer have been reproduced in one booklet, available now.

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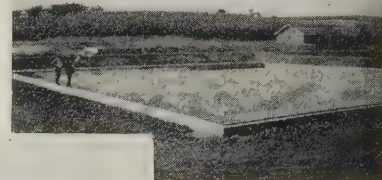
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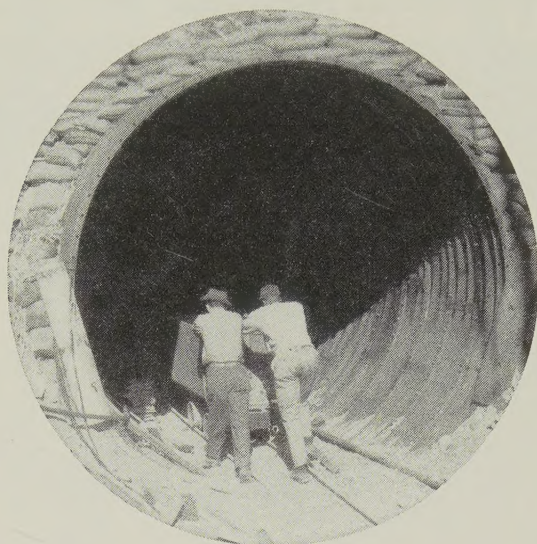
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Structural Engineers, grad. good experience in preparing and checking shop detailed drawings, erection diagrams, etc., of structural steel for buildings, bridges and related structures for an engineering fabricating erecting company. Salary: Open. Chicago. R-7133

Manufacturing Executive, 35-45. Graduate, exp. in mechanical engineering and manufacturing methods, emphasis on metal fabricating desirable. Broad, practical knowledge of machines, dies and tools and proven record in plant management. Salary: Open. Illinois. R-7107

Architectural Superintendent. Age: 30-50. 3-5 years exp. req'd. superintending architectural or contractor's general construction work. Duties: Take charge of construction projects for architect's office. \$400. Chicago. Some traveling. R-7124

Plant Engineer, College Grad. Age: 35-45. 15-20 years exp. req'd. with: plant maintenance in a chemical processing industry. Knowledge of design, maintenance and motive power. Duties: Supervise above activities on processing equipment, with various mechanical craftsmen. Manufacturer of chemicals—soap, fatty acids and glue. \$6000. Chicago. R-7123

Construction Supt. C.E. 30-35 years. 2 years + exp. req'd. Field construction exp. (field construction work) of general industrial, school, institution helpful. Duties: Check field jobs, help trades and sketch for same, expedite materials, good at estimating, deal with trades and architects. For a general builder. Salary: Open. Chicago. R-7114

Building Maintenance Engineer, M.E. or C.E. 2+ years exp. req'd. on plant engineering and industrial building maintenance. Duties: Building maintenance engineering industrial plants. For a manufacturer. \$370-\$400. Chicago. R-7144

Draftsmen. Some technical education req'd. 25 up. 3-4 years exp. req'd with production drawings, valves, fittings, etc. Knowledge of production drawings. Must be able to make

neat drawings. Draft exempt if possible. \$3000-\$4000. Chicago. R-7125(b)

Recent Grad. M.E. to 35. Good training in refrigeration, heating, ventilating, air conditioning and other mechanical phases of buildings. Knowledge of buildings, mechanical equipment. Duties: engineering computations and drafting for contractor-architectural office. \$80. Chicago. R-7126

Research-Plant Engineer. M.E. Age: 20-50. 5+ years exp. req'd. plant engineering, maintenance, construction, plant layout and processing. Knowledge of metal working mfg. operations. Informed about plant layout and construction. Duties: Research and development on maintenance, processing and plant layout projects. Manufacturer of implements. Salary: Up to \$95. Chicago. R-7121(d)

Sales Engineer, Degree. Age: up to 30. Knowledge of air conditioning, heating and ventilating. Informed about commercial and industrial installations. Duties: Sell complete engineering and installation equipment from bills of materials, estimates and specifications. Inside work until qualified to handle sales. Salary: Open. Chicago. R-7140

ENGINEERS AVAILABLE

Maintenance Engineer, M.E., 26. Two and a half years maint. eng. large printing and publishing house. One year drafting, design and development electric motors. About six months testing and laboratory work. \$4800. 753-PE

Plant and Maint. Engr. E.E. 31. Four years plant engr. and maint. Four years research and development electrical products. Chicago and Northern Indiana. \$400. 754-PE

Technical Editor, Writer, Copywriter or Administrative Asst. Grad. work in chemistry and journalism. Five years editing chemical, mathematical, physical, mechanical engineering, medical, biological and meteorological research reports. Two—chemical research. Eight—teaching. Salary: \$4500. Chicago. Female. 755-PE

Purchasing-Production Engineer-Sales Engineer. 38. Familiar with inspection and processing precision parts—close tolerances. Also sales and purchasing close tolerance piece parts. Chicago. \$4500. 756-PE

Plant Engineer, Editor or Publisher. 40. Ten years engineering—two: editor; three: publisher of trade magazine. Will travel. Chicago. \$6000. 757-PE

Field or Office Engr. C.E. 38. Ten years civil engineering drafting and design, railroad bridge structures, grade separation and flood control projects. Two years cement and concrete research. Chicago. \$520 758-PE

Sales Engineer, B.A. 35. Three years selling metal stampings and fabrications. Six years process control and metallurgist ferrous products, and one year selling outdoor advertising. Chicago. \$4200. 759-PE

Distribution or Field Engr. E.E. 26. One and a half years planning and executing telephone programs electrical devices. One year estimating, preparation working drawings, and field supervision electrical contractor. Chicago. \$4800. 760-PE

Management Engr. A.B. 43. Two years selling electronic communications equipment; four years consulting management engineering covering job evaluation, procedures, operational analyses, job standards and production control. Nine years system and methods, office phases. Chicago. \$600 761-PE

Time Study Eng. 26. Two and a half years time study, rate settings and some method—foundry, machine shop and electrical bench assembly operations. Chicago. \$370 762-PE

Architectural Draftsman, C.E. 46. One year checking structural parts, tracing and inking in U. S. Twenty-three years European architectural background; and two years European architectural teaching. Chicago. \$3600. 763-PE

Structural Designer, Detailer and Draftsman. 26. Eleven months layout and design of small buildings; four months transitman on survey party, analysis and design of continuous, Monolithic structures and one year design of sewer structures. \$350 mo. Chicago. 764-PE

General Manager, E.E. and E.M. 62. Very well versed in top management's problem and solutions. Sales, manufacturing, engineering and finance. Varied industrial background ranging from light to heavy operations, processing industries, metals, wood and textiles. Chicago. \$7500. 765-PE

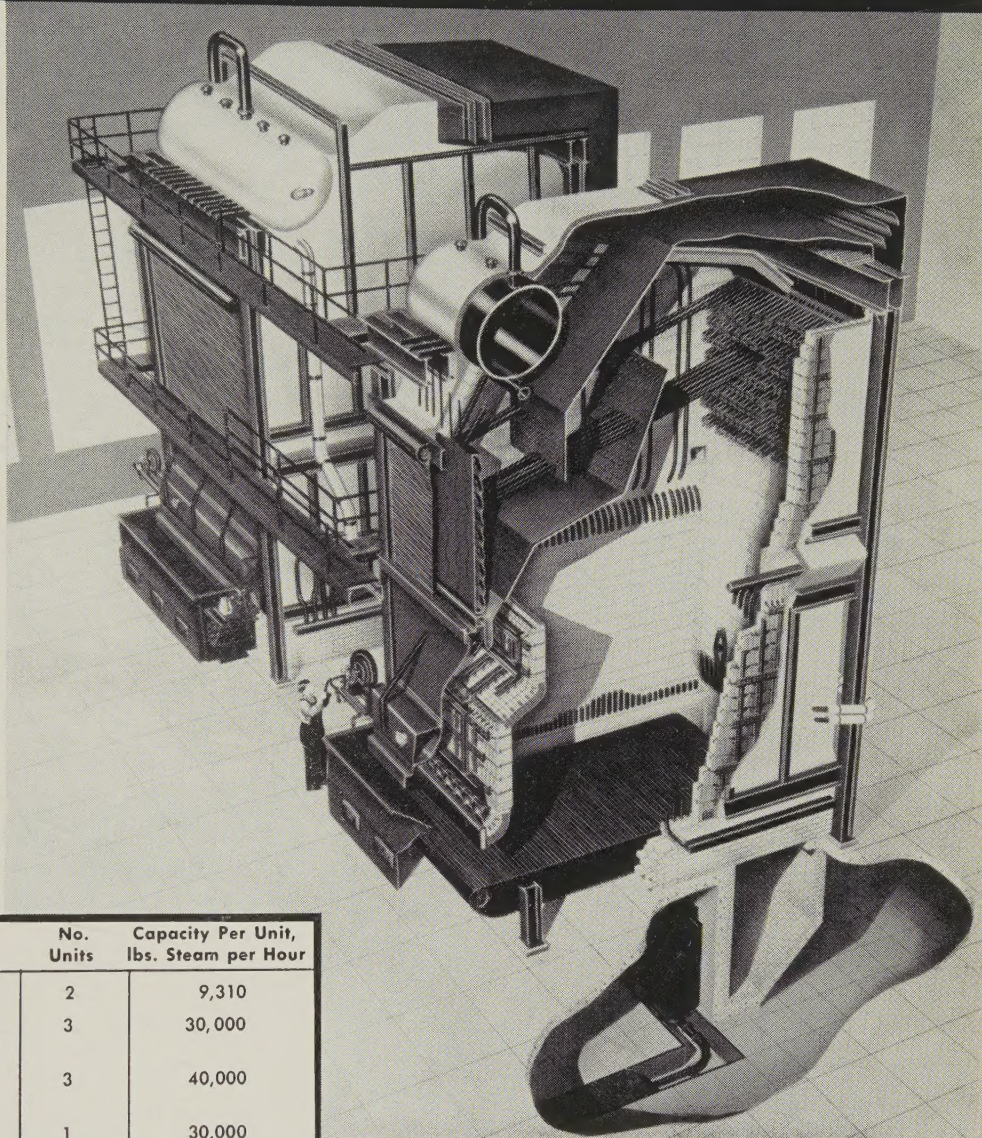
Technical Writer. 29. Two years writing service and technical manuals, water treating and filtering equipment. Three years writing manuals and specifications—agricultural implements. One year ordnance inspection. Chicago. \$4500. 766-PE

3 More SPRINGFIELD Straight Tube Units for the STATE OF ILLINOIS

Units Shown
Installed At
State Capitol Group
Springfield, Illinois

The STATE OF ILLINOIS
Approval of SPRINGFIELD
Straight Tube Boilers Is
Evidenced By The Purchase
of Over 1,000,000 lbs./Hr.
Capacity During The Past
10 Years.

{See Tabulation Below}



Name of Institution	Location	No. Units	Capacity Per Unit, lbs. Steam per Hour
Elgin State Hospital	Elgin	2	9,310
Illinois State Penitentiary	Pontiac	3	30,000
Lincoln State School & College	Lincoln	3	40,000
Western Illinois State Teachers College	Macomb	1	30,000
State Capitol Group	Springfield	3	55,000
Southern Illinois State Teachers College	Carbondale	3	33,000
Jacksonville State Hospital	Jacksonville	3	40,000
University of Illinois	Urbana	3	80,000
Anna State Hospital	Anna	2	24,000
Chicago State Hospital	Dunning	1	45,000
Illinois School for Deaf	Jacksonville	1	27,600
TOTALS		25	1,003,220

**SPRINGFIELD
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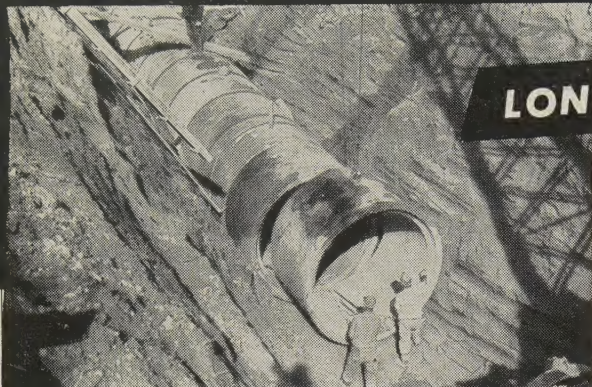
SPRINGFIELD

Designers, Manufacturers, and Erectors of:

BENT TUBE BOILERS • STRAIGHT TUBE BOILERS • SUPERHEATERS • DESUPERHEATERS • AIRHEATERS
ECONOMIZERS • WATERWALLS • PACKAGE BOILERS • COMPLETE STEAM GENERATING UNITS

CONCRETE PIPE

gives you Strength, Durability and Economy



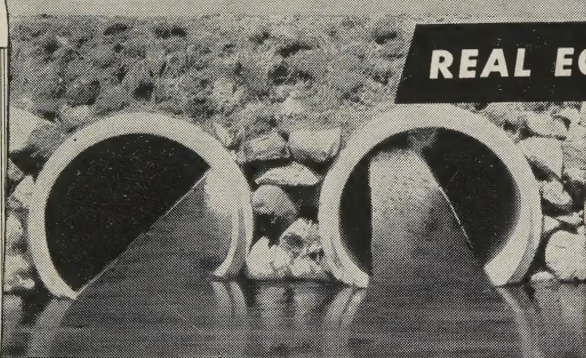
LONG LIFE IN SEWERS

Concrete pipe sewer lines have the strength to resist severe impact and to sustain heavy overburdens. They have the durability to render long years of economical service. Their smooth interior finish resists abrasion and provides maximum hydraulic capacity.



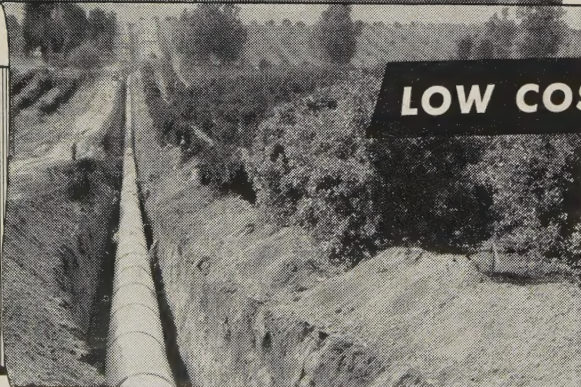
IDEAL FOR WATER LINES

Concrete pipe for water lines is economical and it possesses great structural strength. Its tight joints and uniformly dense structure prevent leakage. There is no incrustation to impair carrying capacity; taste, odor and dirty water difficulties are minimized.



REAL ECONOMY IN CULVERTS

Concrete pipe for culverts is a good investment because of its moderate first cost and simplicity of installation. Its durability has been proved by long service under thousands of miles of federal, state and county highways and many of the leading railroads.



LOW COST FOR IRRIGATION USES

Concrete pipe saves water lost by seepage and evaporation in open ditches, saves land because it is buried *below* the crops and saves money because of its moderate first cost and long life. All of these advantages mean *low annual cost*—the true measure of economy.

PORTLAND CEMENT ASSOCIATION

33 WEST GRAND AVENUE, CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete... through scientific research and engineering field work